Homework 2 - Just Vectors, Must Be Easy

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1. Make the following vectors and matrices.

$$\mathbf{u} = \begin{pmatrix} -2\pi & -1.5\pi & -\pi & -0.5\pi & 0 & 0.5\pi & \pi & 1.5\pi & 2\pi \end{pmatrix}$$

$$A = \begin{pmatrix} -5 & 100 \\ -2 & 101 \\ 1 & 102 \\ 4 & 103 \end{pmatrix},\ B = \begin{pmatrix} 20 & 2 & 2 & 2 \\ 2 & 3i & 2 & 2 \\ 2 & 2 & -6 & 2 \\ 2 & 2 & 2 & 4.5 \end{pmatrix},\ C = \begin{pmatrix} 1 & 3 & 5 & 7 \\ 9 & 11 & 13 & 15 \\ 17 & 19 & 21 & 23 \\ 2 & 4 & 6 & 8 \\ 10 & 12 & 14 & 16 \\ 18 & 20 & 22 & 24 \end{pmatrix}$$

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Hint: For matrix C, I would suggest using reshape() to help generate the matrix instead of typing each row out individually.

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2. Look up the documentation of prod() or factorial() and calculate the value of $\binom{9}{3}$ and $\binom{50}{28}$ (n choose r from combinatorics, no using the function nchoosek()).

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3. As it turns out, we can represent a sawtooth wave as a Fourier series in the form of

$$f(x) = \sum_{n=1}^{\infty} \frac{-\sin(a_n x)}{a_n} \text{ where } a_n = n\pi$$

Calculate the value of f(x) at 2000 equally spaced points in the interval $[-6, 6]$ for n up to 50. Then, plot the resulting values using plot(s, t) where s are the evenly spaced points and t are your actual values for f.

Hint: Broadcasting is very useful here for generating the $\frac{\sin(a_n x)}{a_n}$ terms.